#39

$$f(x) = \begin{cases} 3 - x, & x < 1 \\ ax^2 + bx, & x \geq 1 \end{cases}$$

$3 - 1 = 2$

$a(1)^2 + b(1) = 2$

ⓐ $\boxed{a + b = 2}$

ⓑ $f'(x) = \lim_{h \to 0} \left(\frac{3-(x+h) - (3-x)}{h} \right) = \frac{\cancel{3} - \cancel{x} - h - \cancel{3} + \cancel{x}}{h} = -\frac{h}{h}$

$= -1$

$f'(x) = \lim_{h \to 0} \left(\frac{a(x+h)^2 + b(x+h) - (ax^2 + bx)}{h} \right)$

$x^2 + 2xh + h^2$

$\lim_{h \to 0} \left(\frac{\cancel{ax^2} + 2ax\cancel{h} + ah^{\cancel{2}} + \cancel{bx} + b\cancel{h} - \cancel{ax^2} - \cancel{bx}}{\cancel{h}} \right)$

$\lim_{h \to 0} \left(2ax + ah + b \right) = 2ax + b$

$f'(x)$ when $x < 1 \Rightarrow -1$

$f'(x)$ when $x \geq 1 \Rightarrow 2ax + b \Rightarrow 2a(1) + b = 2a + b$

Slope at 1, $x \geq 1$

$-1 = 2a + b$

$a + b = 2$

$a = 2 - b$

$-1 = 2(2 - b) + b$

$-1 = 4 - 2b + b$

$-1 = 4 - b$

$b = 5$

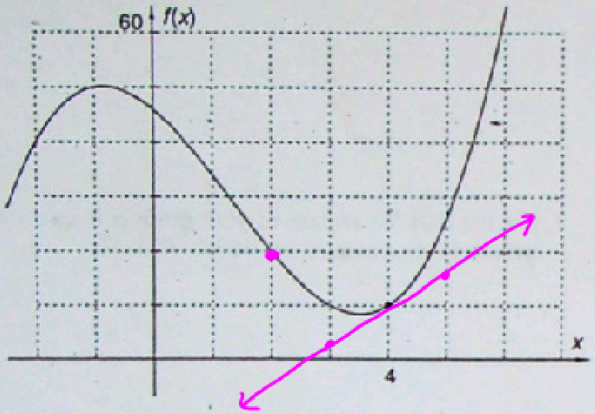
$a + b = 2$

$a = -3$

The figure shows the graph of

$$f(x) = x^3 - 4x^2 - 9x + 46.$$

In this exercise you will use the definition of derivative to find the *exact* value of $f'(4)$.



1. Find $f(4)$. Show that your answer agrees with the graph.

2. Write the definition of derivative as it applies to f at $x = 4$.

3. Substitute the values of $f(x)$ and $f(4)$ into the definition in Problem 2. Then simplify the resulting rational expression, and take the limit.

4. Plot a line on the graph at $(4, f(4))$ that has slope $f'(4)$. Observe the different scales on the two axes. Tell how the line confirms that the derivative is correct.

$m = 7$

$(4, 10)$

$y = 7(x-4) + 10$

5. Find the exact value of $f'(2)$ using the same procedure you used for $f'(4)$. How can you tell quickly that your answer is reasonable?

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$f'(x) = 3x^2 - 8x - 9$

$f'(4) = 7$

$f'(2) = 3(2)^2 - 8(2) - 9$

$f'(2) = -13$

$f'(2) =$

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5. Plot the numerical derivative, $d'(t)$, as y_2. Have your instructor check your graph. ______

6. What is true about the graph of d at the point where $d'(t) = 0$? What is happening to the door's motion at this time?

7. Use the SOLVE feature of your grapher to calculate precisely the value of t at which $d'(t) = 0$.

8. Use the MINIMUM feature of your grapher to find precisely the value of t at which $d'(t)$ is a minimum. What does $d(t)$ equal at this value of t? Put a dot at this point on the graph on this sheet.

9. The point in Problem 8 is called a **point of inflection.** Why do you suppose this name is used?

be smart

Sect. 3.1 # 6, 12, 24, 27, 29, 31, 44

3.2 # 3, Graph the derivative of # 5 - 10